



WATER RESOURCES RESEARCH GRANT PROPOSAL

Project ID: 2005IL62B

Title: The Flow Dimension of Groundwater Resources in Northeastern Illinois

Project Type: Research

Focus Categories: Groundwater, Water Supply, Methods

Keywords: groundwater, aquifer characterization, heterogeneity, dolomite

Start Date: 03/01/2005

End Date: 02/28/2006

Federal Funds: \$19,999

Non-Federal Matching Funds: \$40,562

Congressional District: 15

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Abstract

In some high-growth areas of northeastern Illinois, fractured dolomite aquifers are the only readily available supply of water. Characterizing groundwater flow and contaminant transport in such fractured rocks is complicated by their highly heterogeneous nature, where traditional approaches to interpreting aquifer tests fail because they assume idealized flow geometries. This translates into unreliable parameter estimates and increased uncertainties in managing this water resource. An alternative approach to interpreting aquifer tests is the Generalized Radial Flow (GRF) approach, which infers the geometry of groundwater flow via an additional parameter, the flow dimension, which describes the effective flow area and how it changes with the radius of investigation. Unlike traditional aquifer test interpretation methods, the literature provides few answers as to what models of heterogeneity produce particular values of the flow dimension, or how this might affect subsequent analyses of groundwater resources or their management.

The proposed research will reduce uncertainties in the characterization of fractured dolomite aquifers by determining the parameters of heterogeneity that produce the flow dimensions observed in northeastern Illinois. Various models of heterogeneity will be used in Monte Carlo simulation of pumping tests, followed by manual calibration of parameters, using software developed in collaboration with the National Center for Supercomputing Applications. The software will also be enhanced to improve the numerical analysis of the relationship between the flow dimension and the characteristics of the simulated aquifer.

This research will advance the state-of-the-art in aquifer characterization by elucidating the relationship between models of heterogeneity and the flow dimension. This will have significant broad impact since the flow dimension can be easily identified from a variety of hydraulic tests. Because aquifer tests in fractured dolomite aquifers often show these complex behaviors, the research will have the direct impact of improving management of regional groundwater resources in northeastern Illinois.

The proposed two-year budget, totaling approximately \$45,000, will be used to cover the salary and tuition of a PhD-level graduate student under the joint supervision of the PI's.